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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,187	02/09/2004	Kia Silverbrook	MTB31US	8432

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BALMAIN, 2041		
AUSTRALIA		

EXAMINER	
FIDLER, SHELBY LEE	

ART UNIT	PAPER NUMBER
2861	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/773,187

Applicant(s)

SILVERBROOK, KIA

Examiner

Shelby Fidler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 8/2/2007 & 7/5/2007.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-19,22-38 and 41-54 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4-19,22-38 and 41-54 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 6/18/2007.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/2/2007 has been entered.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 6/18/2007 has been considered by the examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4, 5, 7, 8, 11, 16, 18, 19, 22, 24, 26, 27, 30, 35, 37, 38, 41, 42, 44, 47, 52, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiyama et al. (JP 09-048121) in view of Manaka (JP 07-05943) and Whitman (US 6213587 B1). ~

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Please note that all references hereafter to Fujiyama et al. and Manaka are directed towards the respective translations attached.

Regarding claims 1, 19, and 38:

Fujiyama et al. disclose a printing system incorporating an ink jet printhead, the ink jet printhead comprising:

- a plurality of nozzles (ink regurgitation nozzles 7), each nozzle having a nozzle aperture (Fig. 1);

- a bubble forming chamber (pressurized container 14) corresponding to each of the nozzles respectively (Fig. 1);

- an ejectable liquid inlet (ink feed hole 4a) for establishing fluid communication between the nozzle aperture and an ejectable liquid supply (Fig. 1), the ejectable liquid inlet and the nozzle aperture being aligned such that they have a common central axis (Fig. 1);

- a heater element (heating element 5a) disposed in each of the bubble forming chambers respectively (Fig. 1), the heater element having two bubble nucleation regions (e.g. inner annular ring and outer annular ring of Fig. 3A) within the bubble forming chamber in a plane parallel to that of the nozzle aperture (Fig. 1) such that in use, a layer of ejectable liquid is between the plane of the two bubble nucleation regions and that of the nozzle aperture (Fig. 10A), the two bubble nucleation regions also being laterally offset from the central axis (paragraph 24), the lateral offset of one of the bubble nucleation regions being equal and opposite to the lateral offset of the other bubble nucleation region (Fig. 10) such that,

- heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (air bubbles 9) that causes ejection of a drop of the ejectable

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liquid (ink droplet 8) through the nozzle aperture corresponding to that heater element (paragraph 26), wherein,

the bubble nucleation regions are spaced from each other such that bubbles nucleated at each will grow until they unite to form the gas bubble that causes the ejection of a drop of ejectable liquid (paragraph 26 and Figs. 10A and 10B); and

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (paragraph 29).

Fujiyama et al. do not expressly disclose that the heater element is suspended within the bubble forming chamber on a plane that is less than 50 microns from that of the nozzle aperture.

However, Manaka discloses suspending a heater element (heater element 16) within bubble forming chambers (page 7 and Figs. 13 & 18); and

Whitman discloses positioning heater elements (heater 24) in a plane that is less than 50 microns from a nozzle aperture (col. 8, lines 9-14 and Fig. 6).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a suspended heater element, such as disclosed by Manaka, and to utilize a heater that is positioned less than 50 microns from the nozzle aperture, such as disclosed by Whitman, into the invention of Fujiyama et al. One motivation for suspending the heater, as taught by Manaka, is to improve thermal efficiency and reduce power consumption (page 7). One motivation for positioning the heater less than 50 microns from the nozzle aperture, as taught by Whitman, is that such a positioning greatly improves printhead reliability (col. 15, lines 48-52).

Regarding claims 4, 7, 22, 26, and 41:

Fujiyama et al. also disclose that the heater elements (5a) are formed predominantly from titanium nitride (paragraph 9).

Regarding claims 5, 24, and 42:

Fujiyama et al. also disclose that the bubble forming liquid and the ejectable liquid are of a common body of liquid (paragraph 26).

Regarding claims 8, 27, and 44:

Manaka also discloses that the heater elements are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (page 10).

Regarding claims 11, 30, and 47:

Fujiyama et al. also disclose that each heater element (5a) has two opposite sides and is configured such that the gas bubble formed by that heater element is formed at both the sides of that heater element (paragraph 26 and Figs. 10A and 10B).

Regarding claims 16, 35, and 52:

Fujiyama et al. also disclose that each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 (paragraph 9).

Regarding claims 18, 37, and 54:

Fujiyama et al. also disclose that each heater element (5a) has a conformal protective coating (insulator layer 11) on any parts exposed to the bubble forming liquid (paragraph 32 and Fig. 2), the coating of each heater having been applied substantially to all sides of the heater element such that the coating is seamless (Fig. 2).

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Examiner notes the additional limitation that the coating is applied substantially to all sides of the heater element simultaneously. However, the method of forming a device is not germane to the issue of patentability of the device itself, or to the issue of patentability of the method of using the device. Therefore, this limitation has not been given patentable weight.

Claims 6, 10, 13, 14, 25, 29, 32, 33, 43, 46, 49, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiyama et al. as modified by Manaka and Whitman, as applied to claims 1, 19, and 38 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Fujiyama et al. as modified by Manaka and Whitman do not expressly disclose that the printhead is a pagewidth printhead.

However, Silverbrook discloses a pagewidth printhead (head 200) that is configured to print on a page (col. 6, lines 7-12).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead, such as disclosed by Silverbrook, into the invention of Fujiyama et al. as modified by Manaka and Whitman. One motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

Regarding claims 10, 29, and 46:

Fujiyama et al. as modified by Manaka and Whitman disclose all claimed limitations except that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of

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substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the “part of cyan” section of Figure 43, calculations show that the density

exceeds 10,000 per square centimeter: $\frac{20 \text{ nozzles}}{0.0016384 \text{ cm}^2} = 12207 \frac{\text{nozzles}}{\text{cm}^2}$).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Fujiyama et al. as modified by Manaka and Whitman. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

Regarding claims 13, 32, and 50:

Fujiyama et al. also disclose a structure (metal membrane 16) into which the nozzles are incorporated (paragraph 43 and Fig. 1).

Fujiyama et al. as modified by Manaka and Whitman do not expressly disclose that the structure is formed by CVD.

However, Silverbrook discloses forming a structure (overcoat layer 142) that incorporates nozzles by using a CVD method (col. 8, lines 66-67).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure formed by using CVD method, such as disclosed by Silverbrook, into the invention of Fujiyama et al. as modified by Manaka and Whitman. One motivation for doing so, as taught by Silverbrook, is to provide mechanical strength to resist the shock of collapsing vapor bubbles (col. 8, line 66 – col. 9, line 4).

Regarding claims 14, 33, and 49:

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Fujiyama et al. also disclose that the printhead has a structure (metal membrane 16) into which the nozzles are incorporated (paragraph 43 and Fig. 1).

Fujiyama et al. as modified by Manaka and Whitman do not expressly disclose that the structure is less than 10 microns thick.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure incorporating nozzles that is less than 10 microns thick into the invention of Fujiyama et al. as modified by Manaka and Whitman. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Claims 9, 28, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiyama et al. as modified by Manaka and Whitman, as applied to claims 1, 19, and 38 above, and further in view of Hara et al. (US 4376945).

Regarding claims 9, 28, and 45:

Fujiyama et al. as modified by Manaka and Whitman disclose all claimed limitations except that the printhead is configured to receive a supply of the ejectable liquid at an ambient temperature, wherein each heater element is configured such that the energy required to be applied to heat the heater element to cause the ejection of the drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point.

However, Hara et al. disclose a printhead (recording heat 109) configured to receive a supply of the ejectable liquid (ink 114) at an ambient temperature (room temperature), wherein the heater elements are configured such that the energy required to be applied to heat the heater elements to cause the ejection of the drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point (col. 31, lines 19-21, 26-29; preheating means keeps the temperature in the chamber only 2-3 degrees below boiling, thus requiring less energy to eject a droplet).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize preheating means into the invention of Fujiyama et al. as modified by Manaka and Whitman. The motivation for doing so, as taught by Hara et al., is so that the heat energy of a recording signal effectively serves to form ink droplets and to improve energy efficiency (col. 30, lines 12-17).

Claims 12, 31, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiyama et al. as modified by Manaka and Whitman, as applied to claims 1, 19, and 38 above, and further in view of Campbell et al. (US 4870433).

Regarding claims 12, 31, and 48:

Fujiyama et al. as modified by Manaka and Whitman disclose all claimed limitations except that the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element.

However, Campbell et al. disclose heater elements (heater elements 12) that are configured to form a bubble (bubble 22), wherein the bubble is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (col. 3, lines 60-66).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element configured to form a bubble that is collapsible to a point that is spaced from the heater element, such as disclosed by Campbell et al., into the invention of Fujiyama et al. as modified by Manaka and Whitman. One motivation for doing so, as taught by Campbell et al., is to avoid reduce, or possibly eliminate, damage to the heater (col. 3, lines 14-19).

Claims 15, 34, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiyama et al. as modified by Manaka and Whitman, as applied to claims 1, 19, and 38 above, and further in view of Kubby (US 5706041).

Regarding claims 15, 34, and 51:

Fujiyama et al. also discloses a plurality of nozzle chambers (14), each corresponding to a respective nozzle (Fig. 1).

Fujiyama et al. as modified by Manaka and Whitman do not expressly disclose a plurality of heater elements disposed within each chamber, the heater elements within each chamber being formed on different respective layers.

However, Kubby discloses a plurality of heater elements (doped regions 20a & 20b) disposed within each chamber (Fig. 4), the heater elements within each chamber being formed on different respective layers (col. 4, lines 26-55).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements disposed within each chamber, such as taught by Kubby, into the invention of Fujiyama et al. as modified by Manaka and Whitman. One motivation for doing so, as taught by Kubby, is to provide an ink-jet ejector that is capable of emitting droplets of two distinct sizes (col. 4, lines 56-66).

Claims 17, 36, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiyama et al. as modified by Manaka and Whitman, as applied to claims 1, 19, and 38 above, and further in view of DeMoor et al.

Regarding claims 17, 36, and 53:

Fujiyama et al. as modified by Manaka and Whitman disclose all claimed limitations except that the heater elements are configured for a mass of less than 10 nanograms to be heated to cause ejection of a drop.

However, DeMoor et al. disclose heater elements configured for a mass of less than 10 nanograms to be heated (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000 μ m; heater width = 0.4 μ m. Therefore, the volume of Ti within the heater is 4×10^{-12} cm³, and the volume of TiN within the heater is 2.4×10^{-11} cm³. Using the known densities of Ti = 4.54 g/cm³ and TiN = 5.22 g/cm³, the heater element has an entire mass of 0.14344 ng).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Silverbrook as modified by Fujiyama et al. as modified by Manaka and Whitman. The motivation for doing so, as taught by De Moor et al., is that these types of heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above obviousness-type rejections based on the disclosures provided by Fujiyama et al., Manaka, and Whitman. A logical combination of these teachings provides an ink jet printhead comprising an ejectable liquid inlet for establishing fluid communication between the nozzle aperture and an ejectable liquid supply, wherein the ejectable liquid inlet and the nozzle aperture are aligned such that they have a common central axis.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby Z. Fidler 9/24/07

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